

PREFACE

This text is the compilation of courses developed by the Antonin Svoboda and presented by him while he was Professor Emeritus of the Computer Science Department of the University of California, Los Angeles (UCLA), and of courses developed by one of his graduate students, Donnamaie E. White, and presented by her while she was on the part-time faculty of the School of Engineering, California State University, Los Angeles (Cal-State LA). The material was first combined and presented by its authors at a professional seminar held by the University Extension in early 1977.

Over his lifetime, Svoboda pursued many interests. Those aspects of his work that are represented here are concerned with his **Parallel Boolean Processor** and with his theorems and his unique approaches to finding the minimal or optimal solutions to fundamental combinational and sequential circuit design problems. The **Triadic notation**, which appears heavily throughout many of his published papers, is clearly documented for the first time.

Dr. Svoboda built the world's first fault-tolerant computer, **SAPO**, for the *Academie of Science in Prague*. Designed in 1950, SAPO was operational in 1954.

Chapters 3, 5, and 7 of this text present the complete listings of the APL Circuit Laboratory which Svoboda created while he was at UCLA.

[There are known to be at least 2 typing errors in the listings. The listings are produced as originally published, however, since no APL compiler is available to test them. If you can do so, by all means let the author know.]

A number of examples are included in the surrounding chapters to demonstrate the application of the various APL program modules.

The remaining chapters contain detailed explanations and examples of various design problems from minimization of single-output combinational functions throughout the mosaics of multiple output functions. An explanation of the **Parallel Boolean Processor** and its fundamental theorems is offered without any attempt to duplicate the material included in the referenced published papers. Rather, the intent is to clarify the earlier papers that have been edited down to meet space restrictions at the time that they were published.

*[In other words, some of the reductions for space have proven to be catastrophic, as is the case with the **Triadic Graphical Calculus**.]*

The new, unpublished **COVERAGE algorithm** is described.

Applications of the **Parallel Boolean Processor** are implied, with several new applications presented in detail. These include the development of the **Test Sequence** for fault detection testing of combinational circuits. *[This was later expanded to apply to the determination of coverage for functional testing of ASICs.]*

The minimization techniques:

- the weight algorithm
- fundamental product
- mosaics of functions
- coverage

are representations of the application areas of Svoboda's theorems. In fact, the techniques described in Chapters 8-11 are verbal descriptions of the APL Program Library presented in Chapters 1-7. The **APL Program Package** was written using **Triadic Notation**.

Svoboda's approaches are both unique and elegant in their simplicity. The **Marquand Map**, proposed in 1881 and overlooked by logic designers until recently, and the **Triadic Map** developed by Svoboda are the tools that he used to graphically explain his theorems and techniques. These are the "missing links" which anyone attempting to study the basic fundamentals of Boolean Logic will find invaluable. They [the theorems and techniques] lend themselves readily to algorithmic manipulation via APL.

This book is intended as a reference text rather than as a textbook *per se* although the material has been combined with appropriate exercises and lecture material and used by both of the authors in undergraduate and graduate logic design courses. Its primary function is to document the extensive APL Circuit Laboratory and Svoboda's techniques for the benefit of those who were not privileged enough to have attended his seminars during his lifetime

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- 1) the weight algorithm;
- 2) fundamental product;
- 3) mosaics of functions and
- 4) coverage

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